# WORLD HEALTH

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## Editorial

# Toxic chemicals: the right to know

*Knowledge is the most effective weapon in our arsenal against diseases caused by chemical exposure. At a global level, this "right-to-know" is fostered by the United Nations Environment Programme's International Register of Potentially Toxic Chemicals. The Register pulls together information from diverse international agencies, scientific institutions, government experts and industrial contacts around the world and brings these data to bear on local and national chemical-safety decisions.*

*Mrs Elizabeth Dowdeswell, Executive Director of the United Nations Environment Programme (UNEP).*

Nine hundred years ago a great Islamic physician, Al-Asuli, wrote a medical pharmacopoeia in which he divided the illnesses of the world into two parts: diseases of the rich and diseases of the poor. If Al-Asuli were writing today, he might have to rethink this dichotomy taking account of the new and burgeoning class of human ailments caused by chemical contaminants in the environment.

The media are inordinately fond of sensational examples of chemical illness in the affluent parts of the world: the "sick building" syndrome, the exposure to chemicals in dry cleaning and photocopying businesses, and drug residues in beef, pork and poultry are but a few examples.

In fact, it is often the poor who are at greatest risk of chemical illness – migratory farm workers who absorb pesticides while harvesting crops, subsistence hunters and fishermen who eat tainted fish and animals, and the hungry who must eat whatever and whenever they can, even if they suspect the food is contaminated.

In my native Canada, indigenous peoples of the high Arctic – a thousand miles from the continent's prime agricultural regions – nevertheless show high levels of contamination from certain agricultural chemicals. They are exposed because the Earth's ecosystem is an extremely efficient circulator, and there is no such thing as a stationary contaminant. The air they breathe, the rain and snow they use for drinking-water, the migratory animals they eat – none of these is free from contamination.

Knowledge is the most effective weapon in our arsenal against diseases caused by chemical exposure. In the developed world in particular, such knowledge has been increasingly well served by community "right-to-know" regulations, which require industries that use dangerous chemicals to inform local citizens who can then monitor the toxic chemicals that have been discarded in their neighbourhoods.

At a global level, this "right-to-know" is fostered by the United Nations Environment Programme's International Register of Potentially Toxic Chemicals (IRPTC). The Register pulls together information from diverse international agencies, scientific institutions, government experts and industrial contacts around the world and brings these data to bear on local and national chemical-safety decisions.

In many ways, IRPTC represents a model for the "new" UNEP we are working to bring about. The Register is a management tool that stresses collaboration, consultation, and cooperation above fragmentation and duplication of effort. It empowers citizens and nations to become educated critics of chemical contamination, rather than leaving chemical safety decisions to industry experts. And it catalyses action by enlightened citizens and governments to reduce the adverse effects of chemical exposure, rather than promoting apathy, helplessness, and fear.

Collaboration is not new to UNEP; since 1980 we have been actively engaged with WHO in an International Programme on Chemical Safety, for example. Through this editorial WHO is fostering its vibrant partnership with UNEP, and I look forward to the fruits of our collaboration against chemical illnesses. ■

E. Dowdeswell

*Elizabeth Dowdeswell*

# From Stockholm to Rio

Michel Mercier

Man has known for millennia that he could improve his lifestyle through the use of chemicals. From the earliest days of metal refining to the most recent developments of high-tech materials, he has also realized that, without a certain amount of caution in using those chemicals, his improved lifestyle could be brought to an abrupt halt.

Two thousand years ago Pliny noted a particularly high death rate among mercury miners. During the dramatic expansion of scientific knowledge in the 18th and 19th centuries, chemists discovered many substances that could have harmful effects on human health. The first half of the 20th century saw the appearance of new chemicals in almost all walks of life, but little attention was paid to their potential risks. Then three decades ago Rachel Carson, in her book *Silent spring*, warned the world of the danger to the environment of indiscriminate pesticide use.

Pollution was a key issue at the UN Conference on the Human Environment held in Stockholm in 1972. An analysis was made of the side-effects that accompany development in agriculture, industry, transport and human settlement. Chemical pollution was identified as one of these side-effects; it was characterized as arising out of air pollutants, industrial effluents, pesticides, metals and detergent components. The Conference recommended that programmes (to be guided by WHO) should be undertaken for the early warning and prevention of the harmful effects of the various environmental contaminants to which humans were being increasingly exposed. Other international organizations also had an interest in this area: the International Labour Organisation (ILO) and the United Nations Environment Programme (UNEP) joined with WHO in establishing the International Programme on Chemical Safety (IPCS) in April 1980.

## Assessing the health risks

This programme was set up specifically to produce assessments of the risk of chemicals to human health and the environment, thus providing the scientific basis on which Member States could develop their own chemical safety measures. Since its conception, IPCS has evaluated an impres-

sive list of commonly used and internationally traded agricultural and industrial chemicals. Hazard assessments have been issued for over 1200 chemicals or groups of chemicals, including drinking-water contaminants as well as food additives, and contaminant residues of pesticides and veterinary drugs in food, the latter in collaboration with the Food and Agriculture Organization of the United Nations (FAO). The other major objective set for IPCS was to strengthen national capabilities to prevent and treat the harmful effects of chemicals and to manage emergencies involving chemicals.

It is the major accidents that have done more than anything else to draw public attention to the potential hazards of chemicals. Over the past two decades they have occurred at regular intervals: in 1976 a release of a poisonous dioxin gas known as TCDD at Seveso, Italy, resulted in extensive animal deaths; in 1979 a train derailment in Canada led to chlorine release that required the evacuation of 216 000 people; in 1984 a liquid petroleum gas explosion in Mexico City left 500 dead and 5000 injured; and, also in 1984, leaking methyl isocyanate from a pesticide plant in Bhopal, India, killed 2500 people and blinded and injured more than 200 000.

One of the priority areas of the UN Conference on Environment and Development (UNCED) held in Rio de Janeiro in June 1992 was the quest for an international strategy for the environmentally sound management of toxic chemicals. The conference considered that IPCS should be the nucleus for this strategy, and that cooperation with other organizations having an involvement in chemical safety should be strengthened. These include a number of UN bodies and other programmes such as those of the Organisation for Economic Co-operation and Development (OECD) and of the European Community (EC).

In addition, UNCED stressed the need to extend partnership with governments, industries, trade unions, consumers and professional bodies. It has been proposed that the strengthening of IPCS should be accompanied by the setting up of an intergovernmental forum for chemical risk assessment and management. The key concept is that the cooperating organizations should pool their resources and share the workload, thereby avoiding the duplication of effort that has often occurred in the past.

## The programme's objectives

UNCED identified six programme areas that would form the objectives of the new IPCS.

- The evaluation of the risks to human health and the environment from exposure to chemicals should be accelerated, and international agreement concerning methods of laboratory testing needs to be expanded.
- Agreement on a worldwide scale is also essential for the classification and labelling of chemicals.
- Mechanisms are required to make the exchange of information on chemicals and their risks easier, and to deal with major accidents and poisonings that involve them.
- Activities to reduce the risks of chemicals and to develop the use of safer alternatives (ozone-friendly propellants, for instance) need to be promoted.
- IPCS will also be called upon to provide assistance to countries, especially the developing ones, to evaluate health and environmental hazards, and to bring in and enforce legislation when necessary.
- Finally, more information and stronger measures are needed in the fight to halt illegal international traffic in dangerous chemicals.

Looking further into the future, what will be the direction of IPCS at the beginning of the 21st century? There is no doubt that the number of chemicals in commercial use will have increased still further. The question is not whether the international community is able to provide the information needed to handle present-day chemicals more safely, but whether it is capable of *coordinating* its various efforts sufficiently to keep pace with the ever-increasing demand for information on chemicals, both old and new. ■

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# Europe's toxic waste

Debora MacKenzie

*In 1990 some 40 million tonnes of waste were exported for recycling worldwide. The industry employs 350 000 people and generates revenues of US$ 38 000 million a year. Part of this trade consists of toxic waste shipped from rich countries to poor ones.*

In 1988 the freighter *Karin B* sailed from port to port around Europe trying to find a home for a cargo of hazardous waste that an Italian company had tried to dump illegally in Nigeria. No other incident did more to expose the trade in toxic waste from rich countries to poor. Cases such as this were the inspiration for an international treaty – the Basel Convention – which aimed, if not to ban the trade, at least to give developing countries the right to refuse shipments.

In February this year, however, after sustained pressure from the recycling industry, the European Community formally adopted a policy that labelled a large number of hazardous wastes as non-hazardous, and in many cases put them outside the control of the treaty.

The freedom to send refuse abroad seemed likely to act as a disincentive to Europe's companies to develop technologies that generate less waste. It could also release a flood of toxic waste from Europe to developing countries.

The Basel Convention was drawn up under the auspices of the UN Environment Programme and came into force in May 1992. For the first time, it laid down a common procedure by which importing countries can regulate which wastes they will accept. Every time a country wants to export a cargo of waste it considers hazardous, it must first gain permission from the importer. The importer has 60 days in which to issue this "prior informed consent".

But before the convention was completed, the recycling industry in developed countries had decided that its conditions were going to be too strict. Despite their "green" image, recyclers often deal with substances that are far from green; many would have fallen within the scope of the convention, needing informed consent before they could be shipped.

According to Mrs Christine Massin of the International Federation of Recycling Industries, no recycling firm can afford to wait 60 days for the approval required by the convention.

The value of many recyclables can change in an hour, she says. The load of scrap copper you can sell for US$ 1000 today, you may have to pay someone to take tomorrow. Profit margins are small, and success depends on shifting large volumes quickly.

According to the Organization for Economic Co-operation and Development (OECD) – the club of 24 industrialized nations – in 1990 some 40 million tonnes of waste, worth $19 000 million, were exported for recycling worldwide. The industry employs 350 000 people and generates revenues of $38 000 million a year. Most of these profits go to OECD countries.

Last year, and just weeks before the Basel Convention came into force, the OECD adopted a set of rules to protect the recycling industry. For trade between its member countries, the organization divided hazardous waste into three lists. On the red list are wastes everyone agrees are dangerous and should remain subject to the convention's controls. They include asbestos, polychlorinated biphenyls (PCBs) and chlorinated dioxins. Slightly less dangerous wastes, such as phenol and lead acid batteries, are on an amber list, and subject to less stringent regulations; an importer has 30 days to accept a type of waste, and that consent is good for a year.

The real innovation was the green list, which covers wastes that can be recycled: ferrous and nonferrous metals including lead, cadmium and thorium, plastics, tyres and some types of ash from coal-fired power stations. When shipped for recycling between OECD countries, these substances are considered "non-hazardous", a ruling which frees them from the onerous 60-day wait. For green list materials, a single letter of approval from the importing country covers an indefinite number of shipments.

Within the OECD, the lists were considered unlikely to pose problems: waste would simply go where it could be most efficiently recycled.

## The questionable green list

However, the European Community has now extended this system. The 12 environment ministers included the red, amber and green lists in the Community's waste regulation, which was approved last November and officially adopted in February. This allows member states to export green list wastes for recycling anywhere in the world.

The move was greeted with consternation at the secretariat in Geneva which oversees the Basel Convention. Late last year, Mrs Iwona Rummel-Bulska, head of the secretariat, said that the Community rules could permit the sort of waste trade the treaty was meant to prevent. The convention leaves countries free to define which wastes are hazardous. Defending the Community's adoption of the OECD lists, one official argued that green lists waste is not "Basel waste". The Community's adoption of the green list is likely to increase vastly the number of cases where exporting countries do not regard wastes as hazardous but importing countries do.

Environmental groups argue that unscrupulous waste traders are exploiting the green list by labelling waste "for recycling", and then dumping it. Mr Jim Puckett of Greenpeace claimed that, last year, every waste shipment monitored by his organization was labelled "for recycling". Even if waste is recycled, the processes used still produce hazardous waste. In general, says Puckett, pollution controls in poor countries are weak or nonexistent. Recent studies conducted in Europe show that pollution created by recycling is still a problem in industrialized countries.

Scrap iron and steel are on the green list. In 1990 OECD countries exported 35 million tonnes, of which eight million tonnes were sent outside member states. Recycling scrap iron has some environmental advantages. But the University of Umeå in Sweden found that, when ferrous scrap is smelted for recycling, the process generates chlorinated dioxins, and carcinogens such as chlorobenzene and polycyclic aromatic hydrocarbons.

Copper, nickel and aluminium waste are also on the green list, and pose similar hazards from heavy metals and dioxins, when smelted. Last year, the Dutch environment ministry found illegally high concentrations of dioxins in the soil around nine out of its 15 copper recycling plants. The cost of cleaning such sites, as required by Dutch law, may drive

copper recycling into countries where pollution laws are less stringent.

Plastic scrap is also on the green list. Markets for recycled plastics in Europe and the USA are limited, so vast quantities are shipped to developing countries. Greenpeace estimates that, in 1991, the USA alone sent 100 000 tonnes of domestic and industrial plastics to Asia, Africa and Latin America.

## The dangers of plastic

According to Mrs Anne Leonard of Greenpeace, plastics sent to China, Indonesia and the Philippines are often sorted by people wearing no protective clothing. This exposes them to bacteria, dust and whatever chemicals were originally packed in the plastic. In Indonesia, she herself saw women sorting bags contaminated with pesticides and titanium dioxide.

Many developing countries were disappointed that the Basel Convention did not ban trade in toxic waste outright. Some have since banned waste imports unilaterally and, in 1989, the Organization of African Unity followed suit, laying out its ban in the Bamako Convention. The problem is that only a few countries have ratified that convention.

## A share of the waste trade

Meanwhile, other poor countries are lining up for a share of the waste trade. Malaysia and Albania are building "waste treatment facilities" with few pollution controls to handle imported hazardous waste; 14 companies in Guatemala have formed a consortium to import industrial waste for recycling; and the government of the Marshall Islands bid last year to import contaminated soil from old petrol stations in Hawaii.

In Europe, the cost of waste disposal is now an important factor for companies in deciding where to locate factories and what technologies to use. So long as it is cheap to send refuse abroad for dumping or recycling, what hope is there that European companies will invest in technologies that generate less waste or less hazardous waste? The USA and Japan have already identified "clean technologies" as profitable ones for investment. If Europe fails to keep pace, it could blight its own future as well as that of poor countries. ■

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# Accident-prone Mexico

Lilia A. Albert

Of the world's 55 most serious chemical accidents on record – and they include those of Seveso, Bhopal, and Chernobyl – nine (more than 15%) have occurred in Mexico. The current rate of chemical accidents in this country is one major accident every 18 months and many smaller ones occur frequently at industrial facilities or during the transport of hazardous chemicals. This is far higher than for any other country, regardless of its stage of development.

The results of such accidents are human suffering and financial loss, as well as long-term problems. For example, after the Guadalajara gasoline explosion in April 1992, which caused 202 deaths, 15% of all the demonstrations staged in the city the following year were directly related to the accident. The costs, including rebuilding and compensation, are well over US$ 200 million so far.

In 1984, a few days before the Bhopal disaster in India, there was an explosion caused by liquified petroleum gas (LPG) in San Juanico, on the outskirts of Mexico City. Despite official recognition of some of the causes for the explosion and public demands to relocate the LPG plants elsewhere, they are still there. Several documented gas leakages have occurred since then and there are constant complaints in the community about the smell of gas.

*Nine very serious chemical accidents have taken place in Mexico. So far, not enough has been done to guard against future disasters with their toll of deaths, injuries and financial loss. However, public awareness of the risks is a major new force to which the authorities must respond.*

## Long-term health problems

Following an explosion at the Anaversa pesticide plant which occurred in May 1991 in the city of Cordoba, the community appealed to the National Human Rights Commission which conveyed a recommendation to several authorities, but this has not yet been complied with completely. The community still complains of health problems, particularly neurological ones, which they attribute to the chemicals released by the explosion; and there is still no proper environmental impact assessment of the consequences of the explosion and its possible long-term effects on human health.

These accidents do not only cause loss of human lives and economic damage but also social unrest as in the case of the Guadalajara accident. The country spends much money on compensation and repairs which could be better used if a small part of it – possibly less than 5% – were devoted to detecting hazardous facilities and

activities, preventing accidents, training first-response personnel, providing them with adequate protective equipment and, in general, making the country better prepared for emergencies.

Although it is true that chemical accidents happen in every country, they should alert the authorities to tighten regulations, improve enforcement, and introduce changes that eventually will lead to a reduction in the frequency and severity of such accidents. Mexico ought to be a good example for other developing countries, since this experience could be used to start preparing the necessary mechanisms to control chemical accidents before they reach the magnitude they have in Mexico.

Several steps need to be taken, even if the chemical emergencies that occur are small and not frequent. Since the Guadalajara explosion, for example, there have been positive changes in official attitudes, with reorganization of the national system of civil protection, activation of civil protection units in every municipality, seminars on accident prevention, and the introduction of new regulations. These measures might never have been taken if it had not been for the explosion in Guadalajara.

## Greater community awareness

There is still a long way to go before Mexico develops accident prevention measures in proportion to the number of hazardous facilities and the quantities of hazardous chemicals that are imported, produced and used in the country, as well as trains all the technical people required and provides them with protective equipment. Yet there have been important changes and the clock will not be put back. Not the least of these changes is the growing awareness in the communities of the hazards that the storage, transport and manufacture of chemicals represent -- hazards that were taken for granted until very recently.

## People organize themselves

In all the recent cases of chemical accidents, it was the community that alerted the authorities, surrounded the facility and pressed for its closure. In at least one case, the people forced the authorities to close the plant and obliged its owners to provide medical attention to the people who had been exposed. They have also organized themselves to help in controlling the accident, as occurred at Anaversa, or to search for the dead and injured among the rubble as in Guadalajara. This awareness is a major new phenomenon and a force that will have to be reckoned with in the future.

The most important lesson for other countries is that they should start acting immediately if their chemical facilities are more than 20 years old, or if they are using increasing quantities of hazardous substances. It is far better to start tightening up their regulations after the first minor emergencies and to take serious note of accidents in other countries, than to dismiss the Guadalajaras and the Sevesos just because they took place far away. An ounce of prevention is worth a pound of cure! ■

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# When chemical disasters strike

Peter J. Baxter

Following incidents like the explosion at a cyclohexane plant at Flixborough, England, in 1974 and the release of dioxin at Seveso, Italy, in 1976, great efforts have been made by governments and industry to prevent major chemical accidents involving large vapour or flammable gas explosions, fires or toxic releases into the air, food or water. However, despite legislative and engineering measures aimed at reducing the risks, the possibility of a disaster can never be ruled out. Emergency response measures should therefore be an integral part of planning for accidents at hazardous installations, and during the distribution and transport of chemicals.

Health professionals in such specialties as occupational health, public health, primary care and emergency medicine urgently need to be involved with the emergency services – and involved in the planning, preparedness and rehabilitation phases, not just as part of the emergency response to a disaster. Thus the health sector should participate in disaster management rather than having simply a limited "therapeutic" role.

The essential feature of chemical disasters which distinguishes them from other types of disaster is the need to be able to define very quickly the health hazard posed by a toxic release (for example, a dense chemical cloud) which means rapidly identifying the chemical or chemicals concerned, obtaining knowledge of their acute and long-term effects, and determining who, if anyone, in the general population has been exposed.

Unfortunately it may be difficult or impossible to determine the chemicals involved in the event of a runaway reaction or chemical fire, and even if the identity of the chemical is available, knowledge of its toxicology in humans, particularly with regard to its chronic health effects, may be sparse or non-existent. This was the case following the release of methyl isocyanate at Bhopal, India, in 1984, which killed 2500 people living nearby. Yet without such information on the health hazards, the medical management of casualties and of the exposed population, who may need to be urgently evacuated from a contaminated area, will be severely hampered.

## A multidisciplinary team

Information-gathering by a multidisciplinary team in order to make a rapid health-risk assessment should therefore be an essential part of preplanning for chemical accidents, both at the local and national level. The toxicological databases held by poisons centres, chemical response centres or chemical companies may be inadequate for decision-making in a major disaster, or even in a more modest incident where a community believes it has suffered serious exposure. The team should have the expertise to confirm the nature of the chemical release, and to investigate its likely health effects on the casualties and on the exposed "well" population.

Certain aspects of the management of casualties, whether at the scene or in the hospital, namely the sorting of casualties, decontamination and the treatment of acute symptoms (such as the pulmonary effects of irritant gases) may proceed along standardized lines regardless of the chemical agent concerned, but the treatment of systemic effects and the administration of antidotes involves knowing precisely the chemicals involved and their toxic effects. Unfortunately, hospitals are generally poorly prepared for undertaking even ordinary routine measures for treating chemical casualties.

Since medical treatment is likely to be only supportive in most serious chemical incidents, it follows that preventing exposure must be the main aim of the emergency services. Psychological or stress reactions may prove to be more important than the toxic hazard, and preventing these must also be an essential part of disaster management. ■

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# Protecting the environment

Stuart Dobson

*Lessons learnt from the environmental damage caused in the past have led to the development of more modern chemicals which do not contribute to the decline of animal or plant populations.*

The essential starting-point for assessing the effects of chemicals on the environment ought to be a clear understanding of both "safety" and the "environment". Unfortunately, their definition is more complicated than at first appears. To fully understand the hazards of chemicals, it would be necessary to know about the effects of the chemical on all organisms in all parts of the environment. Clearly this is impossible, even with infinite resources.

The problem of deciding whether a chemical will affect the environment is quite different from deciding if the same compound will affect human health. For humans, each individual is of value and must be protected. In the environment, individual creatures do not warrant protection because the natural death rate is extremely high. For most natural populations of animals or plants, the survival of new offspring each year must be very low. If this were not the case, populations would grow in an uncontrolled way. For stable populations, parents only need to produce one pair of young in their reproductive lifetime.

We make a scientific distinction between preventing any change to the environment and preventing any adverse change. To protect the environment, we need to determine where the chemical will occur within the environmental compartments (for example, in water, in soil and so on), which organisms are most susceptible (for example, bacteria, fish, birds, etc.), and how severe the effect will be (for example, killing a few individuals or whole populations, or changing communities of organisms). It is also important to know whether successful reproduction of organisms is adversely affected; death and reproductive failure are the two factors which can affect organisms at the population level. A "safe" level of a chemical can, therefore, have more than one definition depending on the degree of change that is acceptable – a political rather than a scientific decision.

*Birds are highly sensitive to air pollution, which has even led to the extinction of some species.*

## Birds of prey

The best-studied effect of chemicals on organisms in the environment is the reduction in the numbers of birds of prey and their breeding following the use of chlorine-containing insecticides. In some areas, birds were so severely affected that species became locally extinct. The effect was due to the actions of several different chemicals. Dieldrin kills adult birds whereas DDT, the chemical usually identified as the main culprit, caused thinning of eggshells so that fewer young birds hatched out. It is unlikely that the population effects would have been seen with either chemical individually.

Populations of birds of prey have recovered in many areas of developed countries where the use of these compounds has been restricted or banned. However, both dieldrin and DDT are valuable chemicals for controlling major pests, including those that carry diseases to humans. The balance between environmental damage and human benefit is a political one based on local economics and value judgements. The insecticides which replaced the use of DDT in agriculture were more toxic to humans than DDT; the decision to protect the environment at the risk of increasing human poisoning is not an easy one. Only for these well-studied chemicals can we define a level at which a substance will adversely affect populations. For most chemicals, much less information is available.

In practice, we are often asked to determine the effects of chemicals from the results of a few standard tests on organisms regarded as representative of the environment as a whole.

Usually, we are also given some information on the fate of the chemical. This might be the measured levels of the compound in water, soil or organisms, or it might be, again, laboratory tests which give some indication of how persistent the chemical is likely to be or which environmental compartment is likely to be affected. Lessons learnt from the experience of DDT and dieldrin have led to the development of a more rigorous testing programme for new chemicals. Persistence of chemicals in the environment is a major criteria for testing.

## The lessons of environmental damage

We cannot yet pretend to test the effects of chemicals on the "environment". We test on an extremely simplified model of the environment. Even with detailed, long-term studies in the field, it is often not possible to define exactly what impact a chemical might have. However, we have learnt other lessons from the environmental damage caused in the past, and these have led to the development of more modern pesticides which do not contribute to the decline of animal or botanical populations. ■

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## Pollution-free tourist resorts

WHO is to undertake its first ever survey of water quality for both drinking and bathing-water quality at European holiday resorts. The results, compiled as "Recreational guidelines", will be used to evaluate the touristic potential of beaches and resorts and will highlight areas where over-rapid tourist resort development may be causing serious damage. Hitherto, the European Community has been surveying beaches and bathing-water quality.

Along some parts of the Mediterranean coastline, the Atlantic seaboard and the Black Sea, tap water may taste so bad that it is impossible to drink, and sometimes the nitrate levels in drinking-water are dangerously high. Bathing resorts will be tested not only for the water's bacterial content but also for sanitary facilities, waste and garbage disposal, and for the general quality of the water – whether it contains oil, scum or colouring matter and whether it smells.

Dr Bent Fenger, water and waste scientist at the WHO European Centre for Environment and Health in Rome, considers that tourist authorities and owners of beaches should be put under an obligation to inform bathers about the safety and cleanliness of beaches. He comments: "It will be a very comprehensive survey, and is necessary because there have never been relevant statistics for planners, holiday-makers and governments.

"WHO does not have statutory powers to enforce improvements in areas of low water quality or sanitation, but we hope our recommendations will be taken up." The report should be published in time for the summer tourist season of 1994.

# Chemicals in drinking-water

Peter Toft

*Old water-pipes pose a potential danger to drinking-water; they can be a cause of lead poisoning.*

A supply of good, clean drinking-water is one of the basic requirements for good health. Traditionally this has meant that water supplies should be free from pathogenic microorganisms. As the main goal in supplying safe drinking-water, it has usually been achieved through ensuring a good quality source of water and applying suitable disinfection procedures.

Water has been described as the "universal solvent" because it can dissolve a wide variety of substances. The consequence is that – even when drinking-water is obtained from a relatively unpolluted source – it always contains a wide variety of chemicals, both organic and inorganic, usually at low concentrations. Certain natural substances (such as minerals and gases) impart to water its pleasant tasting properties. Anyone who has tasted chemically pure water will agree that it is insipid, tasteless and flat. However, the presence of certain other chemicals in drinking-water has led to concern about the possibility of adverse health effects. This is why WHO and national governments set standards or guidelines for chemicals in drinking-water at levels which are protective of health.

## What is pure water?

Chemicals found in drinking-water come from three possible origins – the source water, the water treatment process itself, or the water distribution system. Chemicals in the source water include naturally occurring substances (like sodium, arsenic and mercury), natural and man-made radioactive materials (such as uranium and radon), and man-made chemicals (such as pesticides). These chemicals can be picked up by rain water as it falls, or by underground water as it percolates through soil and rocks. Certain chemicals (such as chlorine) are deliberately added to water to kill microorganisms – bacteria or viruses. This can result in the formation of other chemicals such as trihalomethanes (THMs) during the process of treatment at the waterworks. Other substances (such as lead or copper) may come from the pipe materials used to distribute the water to consumers.

The presence of high concentrations of certain inorganic chemicals in drinking-water has been a matter of health concern for many years. In particular, WHO has long maintained recommendations for "heavy metals" such as arsenic, cadmium, chromium, lead and mercury, not only for safe drinking-water but also for safe food.

Arsenic in large doses is well known to be poisonous, but it is now also known to cause certain types of cancer. Cadmium is a widespread toxic metal which commonly occurs in low amounts in food. Chromium exists in the environment in two forms – the trivalent form (Cr III) and the

hexavalent form (Cr VI). The trivalent form is the most common and is not toxic; indeed it is essential to life. But the hexavalent form is a different story; it has been classified by the International Agency for Research on Cancer (IARC) as a human carcinogen – a cause of cancer. To be on the safe side, all chromium in drinking-water is assumed to be toxic.

Lead is rarely found in natural water, and it is one of the few substances which comes almost entirely from the pipes used to carry drinking-water from the waterworks to the consumers. It is dissolved from plumbing systems, either from lead pipes commonly used in older houses or from the lead solder used to join copper pipes. Lead is toxic to the nervous system, and children are particularly susceptible. Long-term exposure to low concentrations of lead can cause adverse impacts on mental development in young children and in the fetus. As for mercury, it is the organic form, methylmercury, which is the most toxic and which affects mainly the central nervous system.

## The case of fluoride

Fluoride is a special case. It is often found naturally in ground water, but is sometimes added deliberately to water to improve dental health. At high concentrations in drinking-water, fluoride can cause fluorosis of the teeth and even of bones in other parts of the body. But at low concentrations, fluoride is protective of dental health and reduces the incidence of tooth decay.

More recently, scientists have focused attention on other types of chemicals detected in drinking-water supplies – organic chemicals. Some of these are pollutants that are often found in low concentrations in our rivers and lakes. Others are actually formed by the action of chemicals used to treat water to make it fit for drinking. Because of the large number of pesticides used in agriculture today, rivers and lakes in intensively farmed regions tend to pick up such chemicals as they run off the areas of application. Other industrial chemicals can also find their way into surface and groundwater sources from waste discharges and improper disposal practices. Some of these chemicals are carcinogens; others can cause a variety of adverse health effects.

## By-products of chlorination

Certain chemicals in drinking-water are formed as by-products of chlorination, a process commonly used to disinfect water by killing bacteria and other microorganisms that are usually present in water from rivers and lakes. Perhaps the most common disinfection by-products are the trihalomethanes (THMs), the best known of which is chloroform; and chloroform is considered to be carcinogenic at high concentrations. However, it is possible to reduce the amount of THMs formed during water treatment by improving the treatment process in ways that do not reduce the ability of the chlorine to kill harmful bacteria present in the raw water. In any event, it is essential to ensure that drinking-water does not contain harmful bacteria, even though small amounts of THMs may be formed as a result. The risks to health from the presence of disinfection by-products are extremely small in comparison to the risks to health from inadequate water disinfection.

Because it is difficult and expensive to remove all toxic chemical contaminants from our water supplies, it is preferable to use as pure a supply as possible and to take steps to protect supplies from contamination. The *Guidelines for drinking-water quality* issued by WHO (three volumes, revised edition 1993 in preparation) can be used by national authorities to judge the safety of water supplies and as the basis for national standards. They can also be used by individuals to check the safety of private wells. ■

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# Air pollution

Leendert van Bree

*Many governments have instituted smog alert systems, which warn the public in advance when air pollution levels are rising dangerously. Such warnings are particularly essential for people with asthma, chronic bronchitis or emphysema.*

Exposure to environmental pollutants is a problem of increasing concern because of the diversity of pollutants in question, the levels at which they occur, and the vast number of people at risk. The effects of air pollution can be observed even below the levels indicated by air quality standards or guidelines, since individuals differ widely in their response. In addition, the young, the elderly, asthmatics, patients with chronic obstructive lung disease, and workers in certain industries may be at more risk owing to an increased biological sensitivity or high inhaled dose.

Oxidant air pollution can occur as a result of increased photochemical activity during warm, sunny weather with low wind speeds. It may occur frequently and for long periods, especially in locations where the air is trapped. During increased photochemical activity, nitrogen oxides and oxygen react under the influence of sunlight and volatile organic chemicals to form ozone and several other compounds. Ozone is considered the most indicative compound for the severity of these episodes, and itself causes adverse effects in airways and lungs. These effects include coughing, difficulty in breathing, chest tightness, and nausea; reduced lung functions with possible lung inflammation, hyperactivity, and alterations in lung clearance; special problems for persons with respiratory diseases; and decreased ability to exercise strenuously. Laboratory animal studies suggest there may be biochemical, immunological, and morphological changes in respiratory tract tissues.

People at increased health risk from acute ozone exposure are those who take a lot of physical exercise, like sportsmen, workers or children; those who are particularly sensitive – the so-called "hyper-responders"; and those suffering from pre-existing respiratory diseases like asthma, chronic bronchitis or emphysema. Repeated or chronic ozone exposure may cause persistent, accelerated decline of lung function (premature aging), as well as lung fibrosis and chronic obstructive pulmonary disease.

The classic "winter-type" episode is an air pollution situation resulting from cold weather and a strong temperature inversion, with increased levels of fuel combustion-related air pollutants. Sulfur dioxide and suspended particulate matter may be used as indicator pollutants to judge the severity of these complex air pollution situations. Adverse health effects include increased respiratory illness, especially in persons suffering from pre-existing respiratory or cardiovascular disease. Severe air pollution can be fatal to elderly persons suffering from severe respiratory or cardiovascular diseases and those in weak physical condition. Several studies have found strong associations between the levels of particulate matter and changes in lung function, morbidity and mortality.

Measures to limit car exhaust gases and emissions from combustion of other fuels have greatly reduced the risk of developing smog. But in large cities, where air pollution is mostly dominated by compounds originating

from local industries as well as vehicle exhausts, heavy air pollution still occurs during stagnant weather conditions.

## An air pollution mixture

Long-term exposure to high levels of air pollution in built-up areas can result from emissions from industry and traffic. The complex air pollution mixture mainly consists of benzene, carbon monoxide, nitrogen dioxide and polycyclic aromatic hydrocarbons, as well as sulfur dioxide and suspended particulate matter. It can cause aggravated respiratory symptoms; accelerated, persistent decline in lung function; carcinogenic effects; harm to the fetus; effects on the nervous and immune systems; and development of chronic obstructive pulmonary disease. These long-term exposures cause increased health risks for the whole population.

Children are particularly at risk. They are affected more severely than adults because their airways are relatively narrower and more easily obstructed, and their oxygen demand relative to body weight is higher, resulting in relatively larger inhaled volumes. They also spend much more time playing outdoors.

Asthmatic people are another group at special risk. Airway inflammation and hyper-responsiveness are thought to be important factors in exacerbating bronchial asthma, so air pollution may aggravate lung disease in persons suffering from asthma, although it is still unclear whether ambient air pollution can actually cause asthma. Ozone exposure may also play an important role in increasing asthmatic attacks.

*Monitoring air pollution levels in China*

## Air quality guidelines

To reduce the effects of exposure to air pollutants, the WHO Regional Office for Europe has drawn up and recommended air quality guidelines indicating exposure levels below which harmful health effects are unlikely to occur. In many cities, both short-term and long-term guidelines are frequently exceeded. WHO has also recently established exposure-effect relationships for the short-term health effects of photochemical "summer-type" and classic "winter-type" air pollution.

It seems clear that hundreds of millions of people living in cities around the world are exposed to relatively high levels of air pollution, which threaten their health. Although much more information on urban air quality and the risks to health are needed, there is sufficient scientific evidence to justify bringing in control strategies and abatement actions to improve air quality. Economic growth, urbanization, and the increasing number of people exposed strongly reinforce this need.

People can be advised to limit their exposure to air pollution by taking preventive measures. Many governments have instituted smog alert systems which issue warnings to the public, and especially to sensitive subgroups, when air pollution is rising dangerously. By limiting the time spent in air pollution situations and reducing physical exercise on such occasions, it is possible to reduce exposure significantly and thus to lower the health risks. ■

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# Hazards in the home

Wayne A. Temple & Nerida Smith

*Almost every part of the house contains substances that may pose a danger to health. Small children are particularly vulnerable to accidental poisoning. Store chemicals and drugs out of their reach!*

Every day, we may use many chemicals in the home – substances like detergents and other cleaners, fuels, paints, weed-killers, insect sprays and medicines. Just how safe are these products? What may happen if a young child or family pet should accidentally swallow one?

Poisons information centres throughout the world give advice every day on how to treat poisoning caused by household products. Usually these poisonings are accidental, and children between the ages of nine months and five years are most at risk, although adults too can be poisoned. To help illustrate the dangers of some household products, let's take a trip around a home and explore the places where common poisons may be found. Cases taken from the files of the New Zealand poisons information centre show how easily some of these poisonings can occur.

*Powerful drugs may look like sweets – but they can be lethal.*

## In the kitchen

- drain cleaners
- oven cleaners
- detergents, caustics
- furniture polish

*Store your kitchen chemicals out of children's reach and away from food.*

Mothers should never turn their back when using household cleaners, as most accidental poisonings happen in the kitchen, usually when a child has been left alone for only a few minutes. While his mother answered a knock at the front door, 18-month-old Jonathon ate a small amount of caustic soda that she was using to clean the drain. Within minutes he had severe burning of his mouth and throat. He needed urgent hospital treatment, and five years later he still has to swallow a rubber tube twice a day to stop his scarred throat from closing up and choking him.

Caustic household cleaners can cause severe burning if swallowed or put on the skin. Symptoms of poisoning include redness around the mouth, drooling and difficulty in swallowing. Never make someone who has swallowed a caustic substance vomit or give a "neutralizing" agent, as the chemical reaction can cause further burning. It is best to give water (about a cupful) and seek emergency advice – ideally by telephoning a poisons information centre.

## In the bathroom

- medicines
- aftershave

- anti-dandruff shampoos
- toilet and bath cleaners

*Store all medicines in a locked cupboard, well out of reach of children. Take old, unused medicines back to the pharmacy for disposal. Follow the directions on the labels of medicines and cleaners.*

Relatives found Mrs Wood, a 72-year-old widow, dead in her bathroom. She had been cleaning her bath with bleach, and had also used an acid cleaner which reacted with the bleach to give off chlorine gas. Mrs Wood was overcome by the gas and died from severe lung damage. Some cleaning products, such as ammonia, bleach and acid cleaners, when mixed together may produce toxic gases. Take heed of any warnings on the labels of cleaning products.

## In the bedroom

- perfumes
- cosmetics
- mothballs
- medicines

*As well as storing all medicines in a locked cupboard, well out of reach of children, keep perfumes and cosmetics out of reach too.*

Two-year-old Sally was found drinking a bottle of her mother's favourite perfume. Her father telephoned the poisons information centre and was told to give her something sweet to drink and take her to the hospital. Sally had been poisoned by the alcohol in the perfume, and stayed in hospital overnight for treatment.

Three-year-old Sam was visiting his grandparents. His grandmother's heart medicines were kept on her bedside table. Sam, who had chased the cat into the bedroom, found the tablets and thought they were sweets. He swallowed several before showing the container to his grandmother. She called the poisons information centre, and was told to give some ipecacuanha syrup to make him vomit, and to take him straight away to the hospital. Sam was lucky, as the prompt treatment saved his life. His grandmother now locks all the medicines away when children visit the house.

Ipecacuanha syrup is a medicine which can be bought from pharmacies and is used to make people vomit up poisons they may have swallowed. It should only be used after seeking advice from a poisons information centre or qualified health worker. Never use salt water to make people vomit, as it can cause salt poisoning – which can even be fatal.

*Toxic domestic products should be kept in childproof containers.*

## In the living area

- mini-batteries
- alcohol
- cigarettes
- matches

*Check your living area for items that could be dangerous if your child swallows them. Never leave children unsupervised.*

Peter, who was 13 months old, swallowed a mini-battery that he found on the floor. It had been dropped by his father who had been fixing his watch. Peter's father was advised by the poisons information centre that – since the battery could become stuck in Peter's throat or stomach and cause burning or leak dangerous chemicals – he should take him to the hospital for an X-ray. The X-ray showed that the battery was in Peter's stomach, and two days later the battery was passed out in a bowel motion.

Cigarettes contain nicotine; it only takes two cigarettes eaten by a child to cause severe vomiting and diarrhoea.

## In the laundry room

- detergents
- disinfectants

*Store these chemicals out of sight and out of reach of small children and animals. They can cause vomiting and diarrhoea if swallowed, and may damage the lining of the stomach.*

## In the garden or garage

- slug baits
- rat-killers
- weed-killers
- fertilizers
- petrol
- kerosene
- paints
- paint thinners
- methylated spirits
- battery acid

*All of these products should be stored safely out of the reach of small children and animals. Never transfer them into food or drink containers, as they may be mistakenly eaten or drunk, with serious results.*

A man who was cleaning out a garage for a friend found a beer bottle with some dark liquid in it. Thinking it was beer, he drank several mouthfuls before realizing it was something else. The bottle contained paraquat (a herbicide) which requires prompt medical treatment. Unfortunately, there was a long delay before he reached the hospital, and despite the best medical care available he died after two days.

Children may sometimes try to copy their parents whom they have seen syphoning petrol. Fuel products such as petrol and kerosene pose a particular problem if accidentally swallowed. If the children then cough or vomit up the fuel, some droplets of the fuel may be breathed into the lungs and cause a serious pneumonia-like illness. Instead of being made to vomit, they should be given some water to dilute the stomach contents and taken to hospital for treatment.

The chemicals found in our homes are used to make our lives easier, but if they are misused or stored incorrectly they can be dangerous. How safe is *your* home? ■

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## The elderly are more vulnerable

With increasing age, people become more vulnerable to the harmful effects of environmental chemicals due to the deterioration of physiological and biochemical processes, which include certain age-related biochemical, morphological and functional changes associated with the nervous system. For example, the elderly are likely to suffer more than younger people from exposure to carbon disulfide and to certain pesticides.

There has been a particular interest in a possible link between aluminium toxicity and Alzheimer's disease, a common central nervous system disorder of the elderly. Elevated aluminium levels were found in the autopsied brains of Alzheimer's patients in some studies, but not in others. Brain aluminium levels appear to increase as a function of age. The neurological symptoms resembling Parkinson's disease exhibited by monkeys suggest a possible link between environmental exposure to manganese and the occurrence of this disease in elderly people.

The absorption and distribution of chemicals in the body may change with aging. For example, the absorption of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and related chemicals is greatest at weaning, decreases at maturity, and then undergoes a further decline during aging.

Aging can also lead to an increase or a decrease in the metabolic activity of various organs and tissues. Thus an increase in toxicity may also result from the fact that both renal excretion of chemicals and their hepatic elimination become less efficient in the elderly.

# Hazards in the workplace

Albert J. Nantel

Ever since the discovery of fire and the progressive replacement of stone tools and weapons by bronze and other metals, man has exposed himself to various toxic chemicals while working on these new materials. As centuries went by, the number of substances and procedures involved increased steadily, and so did the potential risks for human health. The period of rapid industrialization and the discovery of numerous synthetic chemicals caused occupational hazards to become a serious medical, social and economic problem.

The appearance of tens of thousands of new commercial products every year has also favoured the development of better technologies in industrial hygiene, more knowledge in the field of toxicology, and a wider understanding of the concept and application of prevention programmes. The question is whether this promotion of primary prevention of occupational diseases has been sufficient to contain the risks for human health produced by workplace conditions. Anyone who has worked in this area will concede that the answer is: No.

*The number of new chemicals being developed far exceeds the capacity of toxicology to identify the exact impact of these substances on human health. Programmes aimed at educating employers and employees on the health risks of industrial chemicals deserve a high priority.*

A multitude of factors may explain why the prevention of occupational diseases lags many years behind the production of old and new risks. First, it is important to remember that most workers, even in highly industrialized countries, are employed in small or intermediate-size industries. They use procedures that are still artisanal, and frequently lack the knowledge or the financial capacity to provide adequate ventilation, equipment for protection, and surveillance programmes for the workers.

## Industrial secrecy

Even in large, multinational industries, all the problems are far from being

solved. The number of new chemicals being developed far exceeds the capacity (technical and financial) of toxicology to identify the exact impact of these substances on human health. The fear of losing commercial competitivity has also favoured policies of industrial secrecy about the chemical composition of commercial products. Consequently a large proportion of workers are unaware of the precise nature of the chemicals they are handling on a daily basis. To counteract this problem, some countries, such as Canada, have promulgated laws which oblige firms to identify the active and potentially toxic ingredients of their commercial products on containers and safety data sheets. Even in such cases, many toxic contaminants may be produced during industrial processes or generated as waste materials.

Another cause of concern is the lack of financial resources that many developing countries face in coping with their progressive industrialization. This shortage of funds favours the development of industrial processes without the required security and equipment for safety.

Finally, occupational diseases and, more specifically, acute or chronic intoxications in workers are often incorrectly diagnosed because physicians are not specifically trained in this area, and because the signs and symptoms of the poisonings are not specific and may mimic health problems of various origins. A worker who has been overexposed to a chemical, a group of chemicals or contaminants may not feel sick immediately. The first signs or symptoms may be delayed a few hours and – in the case of long-term exposures – the delay may be months or even years. The relation between cause and effect is then far from obvious. Here are a few practical examples.

A worker is exposed to lead dusts in a small industry producing car batteries. There is no medical or biological surveillance programme for the workers (such as measurement of the blood level of lead). After a few years, he starts complaining of general fatigue, headaches, decreased appetite, loss of sexual desire, irritability and sleep disturbances. If he consults his family doctor, chances are he will end up with a diagnosis of anxiety, stress, psychosomatic problem or depression, and will be given vitamins, tranquillizers or antidepressant drugs. In a more severe case, he will complain of constipation and abdominal pain. He may well be subjected to exploratory abdominal surgery if lead poisoning is not diagnosed.

Again, a worker may be operating a dry-cleaning machine in a small shop with no ventilation or filtering system to get rid of the volatile solvent used (trichloroethylene). Each day during the working week, he feels more and more dizzy. He complains of headaches, irritability, sleepiness and lack of concentration. On Friday night he stops off in a bar with friends and drinks two beers; on the way home he has a car accident. Because his behaviour is that of a totally drunk individual, he is accused of driving with impaired faculties. In fact, since the human body takes more than 24 hours to get rid of the solvent absorbed during a day's work, he has accumulated more and more of this toxic substance and at the end of the week is suffering from trichloroethylene intoxication. The interaction with the alcohol he drank convinced the police he was a drunk driver – but no one made the connection with the occupational factor involved.

Finally, suppose a farm worker has been spraying his field with an organophosphorus insecticide on a hot summer day. Because of the heat, he decides not to use protective clothing, gloves or a face-mask respirator. From time to time, the wind drifts the spray back to him so his clothes become progressively wet. During the night, he starts to complain of headaches, drowsiness, nausea, abdominal cramps and difficulty in breathing. At the hospital he fails to mention that he has used insecticides that day. He feels very weak and has diarrhoea and an urgent need to urinate. With this clinical picture, infectious gastroenteritis is diagnosed and he is treated with fluids and antibiotics. His symptoms gradually subside after 48 hours and he is released from hospital. Organophosphate poisoning is never suspected, so no specific antidotes are administered and no future preventive measures are recommended.

## Lessons to learn

We should learn the following lessons from these examples.

- Proper information to workers on the exact nature of the chemicals they are required to use is a prerequisite for any prevention programme.
- The contaminants that some industrial processes may produce should be identified so as to determine the risk for human health (e.g., oxides of nitrogen produced by diesel engines).

*Personal protection for herbicide spraying is often costly and may not be appropriate in tropical climates.*

- Health professionals need to ask the right questions and learn precisely what type of chemical exposure may have occurred in the previous hours or days when they are consulted by a patient, in order to include occupational overexposure as a possible diagnosis of the observed signs and symptoms.
- The exact chemical composition of industrial products is not always easily available to workers and health professionals; many employers are still reluctant to give this information lest they disclose important industrial secrets.
- Prevention at the source (i.e., advice to use less toxic substances, to have proper ventilation, adequate storage, and safe handling) is the most appropriate strategy.
- Individual protective measures are frequently not used in practice because of ignorance, unavailability of equipment, the cost of the equipment, climatic conditions, and so forth.
- Unless an occupational intoxication is properly diagnosed, the required specific treatment will not be administered and long-term damage to the worker's health may ensue.

For all these reasons, it is essential that national and international programmes aimed at educating both employers and employees on the health risks of chemical substances and chemical contaminants should receive a high priority if we wish to reduce the toll of mortality and morbidity in the workplace. ■

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## The hazards of mercury

Substantial amounts of mercury occur in the environment as a result of natural emissions – for instance, from volcanoes. However, these levels have increased considerably as a result of industrial activities such as mining, metal smelting, cement making, and the incineration of batteries and mercury-containing paints.

Metallic mercury is used in chemical manufacturing processes, in electrodes for certain electrolytic processes, in thermometer manufacture, in certain paints, in dental amalgam, and in laboratory processes. Occupational exposure can occur in each of these situations, which may also cause pollution of the atmosphere, rivers and lakes. When it is breathed in, metallic mercury can produce effects on the nervous system, and on the kidney and skin after being converted in the body to inorganic mercury compounds.

Some inorganic mercury compounds have been used in the past for medical treatment, and they are currently found in certain paints and cosmetics. Inorganic mercury compounds also occur as metabolites of organic mercury compounds that break down in the body or in the environment. The kidney and skin are the main target organs, but they may also affect the menstrual cycle and fetal development.

Mercury is most toxic when it is converted, principally by microorganisms in the aquatic environment, to methylmercury. Since methylmercury is very stable, it accumulates in the food chain and especially in predatory fish. People who eat large quantities of these fish are therefore particularly at risk. This first occurred on a large scale during the 1950s and 1960s in Minamata, Japan. A more recent, though less serious poisoning outbreak occurred among Canadian Indians.

Methylmercury affects the central nervous system; high exposure levels may lead to difficulties in walking, talking and hearing, and eventually result in death.

# Danger: Poison!

Ossy M. J. Kasilo & Charles F. B. Nhachi

*Paraffin poisoning proved to be the second biggest cause of hospital admissions in Zimbabwe for poisoning due to household chemicals. Carbon monoxide and pesticides also regularly cause deaths and sickness – as do such natural hazards as snake-bites and scorpion stings.*

How much harm is done to an individual through contact with a chemical depends on the route of exposure, that is, how the chemical gets into the body: the quantity of the chemical; the duration of exposure to the chemical; the age of the person, and his or her health status at the time.

Children are at particular risk of poisoning as a result of swallowing chemicals that are commonly used around the home, and inhaling carbon monoxide in smoke. For example, a retrospective study of hospital admissions in Zimbabwe found that 90 (4%) of the 2236 children below 15 years of age admitted during 1980-89 were victims of carbon monoxide poisoning. They were mostly very young children who had been ill; as a form of curing the illness and "sending bad spirits away" they were exposed to smoke, using traditional herbs which were added to the fire or hot stone according to a local cultural belief. Unfortunately, some of these "smoked" children were poisoned by a combination of smoke and toxic fumes from the herbs and fuel; they also suffered from carbon monoxide poisoning and hypoxia (lack of oxygen). Most of the children recovered, though some required treatment with pure oxygen.

Petroleum distillates such as kerosene or paraffin, if taken by mouth, may cause oedema (fluid) in the lung. A high prevalence of accidental paraffin poisoning of children has been reported among poor communities in countries as far apart as India, Turkey, Uganda and Zimbabwe. A study in Zimbabwe focusing on poisoning admissions in six major hospitals found that household chemicals represented the second biggest cause (1192 cases) of admissions, after traditional medicines (1378 cases). Some 12% were suicides or attempted suicides and 285 of the 1192 cases died. Paraffin alone accounted for about 20% of cases of poisoning in children involving household chemicals; most of the victims were under five years of age. In country areas without electricity, paraffin is the main source of fuel, and it is a commonly used cooking fuel in city slums. Obviously, shopkeepers should be discouraged from selling paraffin for domestic use in a variety of old bottles which had contained inoffensive products.

## Do not drink

Pesticides, too, are often stored (or even sold) in inappropriate containers and may easily be mistaken for soft drinks. Correct labelling in Zimbabwe calls for pesticides to be marked with a purple triangle (indicating a very dangerous poison), a red triangle (a dangerous poison), an amber triangle (a poison), or a green triangle (harmful if swallowed). For each category

*African farmers spraying insecticides: they should be wearing protective masks.*

there are recommended safety precautions to be followed. Users should learn the recommended safety precautions for each coloured triangle.

A study of health hazards resulting from the use of pesticides based on organophosphates among farm workers in Zimbabwe showed that most poisoning incidents occur during the spraying season, December to March. Another study, involving 942 people, found that 75% of urban poisoning cases were suicides and attempted suicides. The single most vulnerable group comprised those aged between 21 and 30 years. A sizeable amount of the health budget could be saved if stricter legislation were introduced in order to prevent access to pesticides by unauthorized persons.

In many countries, snake-bites are among the common causes of poisoning. Anyone attending to a snake-bite victim should try to identify the snake or kill it and bring the specimen to the hospital for identification. The wound should be cleaned quickly, but gently, with soap and water so that there is no venom left on the skin. The victim should lie on one side to lessen the risk of vomit being inhaled, and should be moved as little as possible especially around the area of the bite. All tight clothing should be removed or loosened before the swelling becomes too severe to do so, and the wounded limb should be bandaged. Ideally the victim should be transported to a medical facility as soon as possible for specific treatment.

*Collecting snake venom in order to prepare life-saving serum.*

In the case of a scorpion sting or spider bite, the wound should be cleansed using an antiseptic solution and covered with a dry dressing. The patient should be reassured and a doctor should be consulted if the signs and symptoms persist. ■

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## Emergency action for poisoning

*Inhaled poison.* Immediately get the person to fresh air, or open doors and windows wide. Avoid breathing fumes. If the victim is not breathing, start artificial respiration.
*Poison on the skin.* Remove contaminated clothing and flood the skin with water for 10 minutes. Then wash gently with soap and water and rinse. In case of a burning sensation, consult your doctor.
*Poison in the eye.* Flood the eye with generous amounts of water for 15 minutes. Have the patient blink as much as possible while flooding the eye. Do not force the eyelid open. In case of irritation, consult an eye specialist.

***Swallowed poison***

- Medicines: Do not give anything by mouth until medical advice has been sought.
- Chemical household products: If the patient is conscious and not having convulsions (fits), and can swallow – give milk or water immediately, then call for professional advice concerning further treatment.

***ALWAYS KEEP WITH YOU:*** a small bottle of syrup of ipecacuanha. Use only when advised by the poison centre or hospital emergency department, or a physician or pharmacist.

## The ozone layer

The ozone layer is a protective envelope of ozone existing naturally in the stratosphere which absorbs most of the sun's ultraviolet radiation. Scientists have been concerned in recent years because an ever-increasing "hole" in this layer is occurring over the Antarctic and the layer is also thinning elsewhere, faster than predicted. Depletion covers North America, a large part of South America and Asia, nearly the whole of Europe, Australia and New Zealand.

One plausible cause of this phenomenon is the release through human activities of gases containing chlorine and bromine which destroy ozone. Aerosols and the gases contained in old jettisoned refrigerators, mainly chlorofluorocarbons (CFCs), have been specifically blamed.

In spite of current international regulations, atmospheric levels of chlorine and bromine are expected to increase for another decade or so, causing an ozone decrease in the 1990s like that or stronger than that of the 1980s. The increased ultraviolet-B radiation (UV-B) can have possible harmful effects on humans and aquatic organisms. Spring and summer are, of course, when people sunbathe and expose themselves to UV-B. Current estimates predict a 5% to 10% ozone depletion for mid-latitudes in summer by the year 2000 compared to the mid-1970s. Environmental impact assessment reports show that if there were a sustained 10% loss of ozone, one could expect a 26% increase in the incidence of non-melanoma skin cancer owing to increased exposure to UV-B.

All industrialized countries have taken steps to conform with the phase-out of CFCs by 1995, in accordance with the requirements of the amended Montreal Protocol. In general, developing countries too are taking action to substantially reduce their consumption of ozone-depleting chemicals.

*Contributed by Eirah Gurre-Dale, Office of Information and Public Affairs, World Meteorological Organization, Case Postale 2300, 1211 Geneva 2, Switzerland.*

# Time to blow the whistle

**Romeo Quijano, Lynn Panganiban & Nelia Cortes-Maramba**

*The dangers from chemicals are incalculable. There is an urgent need to stop the alarming trend towards poisoning humanity and the planet itself.*

*Taking a big risk: a farmer uses his bare hands to measure pesticide directly into his back-pack sprayer.*

We live in a toxic environment. There are about ten million known chemicals – many highly hazardous – used or spewed out in agricultural, manufacturing, transport, mining, power generation and other human activities. Between one and two thousand new toxic chemicals are marketed every year. Among these are pesticides, metallic poisons, hydrocarbons, solvents, illicit drugs and pharmaceuticals. People are also exposed to air pollutants (emissions from vehicles and industrial plants), industrial and consumer wastes, as well as toxic substances found in cigarette smoke, alcoholic drinks, cosmetics and many other consumer products.

In the Philippines, the Department of Environment and Natural Resources has initiated the Philippine Inventory of Chemicals and Chemical Substances (PICCS), which to date has listed over 3000 chemicals and expects to have more than 10 000 on its files by the end of 1993.

Chemicals have been associated with different types of cancer; they can damage the genetic material in the unborn child and cause abortion or malformation; and they can damage the brain, liver, kidney and other vital organs. There is evidence that some of these substances, especially pesticides, can be immunotoxic, the effect of which makes the individual very susceptible to various types of infection – not too different from what happens to an AIDS victim.

## Pesticides may kill

The health and environmental costs and the extent of human suffering that these toxic chemicals leave in their trail are staggering, especially in developing countries where there are less stringent regulatory controls, if any exist at all, and less effective application of whatever laws there are to protect public health and the environment. A considerable number of toxic chemicals are sold in developing countries, including those that have already been banned in developed countries, and more people are exposed to them due to ignorance and lack of protection.

A United Nations report suggests that there are about two million poisonings and 10 000 deaths a year from pesticides; about three-quarters of the deaths occur in developing countries. In the Philippines, a recent report showed 1302 poisoning cases between January 1992 and March 1993 in the National Capital region alone; and a study in Central Luzon showed a 27% increase in mortality, which translated to about 900 farmers dying every year in one province alone due to exposure to pesticides.

An FAO regional director made the observation that Philippine farmers use ten times more pesticides than are necessary. From 1987 to 1989, the major pesticide companies in the Philippines put on the market 20 100 tonnes of pesticides. Pesticides sales grew by 70% between 1988 and 1992, and will amount to about US$ 120 million this year. It is not surprising that a study by the Bureau of Plant Industry in 1990 showed that pesticide residues in samples from locally sold vegetables and fruits such as string

beans, eggplants, tomatoes and mangoes exceeded the maximum allowable levels set by WHO.

This alarming load of pesticides has arisen because of the aggressive marketing and promotion practices of some pesticide companies, and the inadequate political will on the part of the government to control them effectively and protect people's health. Although the Philippine government has a regulatory agency for pesticides under the Department of Agriculture, its very existence is flawed because it is mandated primarily to "assure the agricultural sector of adequate supplies of fertilizer and pesticide at reasonable prices", and only secondarily to protect the public from the risks inherent in pesticide use. The agency, therefore, has allowed the marketing of highly hazardous pesticide formulations, including five of the so-called "dirty dozen" pesticides.

## Hazards in the workplace

Poisoning at the workplace is not uncommon in a developing country like the Philippines. Because of inadequate regulation and control of factories and establishments, and the poor implementation of existing occupational safety programmes, chemicals are mishandled or improperly used, and this results in unnecessary harm to the workers.

About 21.5 million of the labour force are employed in some 500 000 establishments, most of them belonging to industries which widely use chemicals. The National Poisons Control and Information Service at the Philippine General Hospital estimates that about 7.4% of cases of poisoning occur at the workplace. The incidence of illnesses and disabilities caused by low-level chronic exposure are not documented and are largely unknown, except perhaps for a few case reports of neurological, kidney and other disorders.

Lead poisoning has been detected in workers employed in car and battery manufacturing plants. They developed nerve damage manifested as severe tingling or pinprick sensations and weakness of the extremities. Mercury poisoning has been documented among workers in the gold-mining industry, with signs of kidney injury. Hydrogen sulfide poisoning has occurred among workers at geothermal plants in one region of the country, two of whom died. Many other cases of work-related poisonings, especially the chronic ones, remain largely unrecognized and unreported.

## Risks in the home

Accidental chemical poisoning is a common occurrence, mainly due to carelessness in handling and storing chemicals. The unsafe practice of putting kerosene in soft-drink bottles and leaving them within reach of children can be fatal if the child mistakes the contents for water. Kerosene ranks No.1 in cases of poisoning of children aged from one to five years, and has recently appeared in the top-ten list of diseases even in the paediatric emergency room of the Philippine General Hospital. The storage of cleaning chemicals at home also puts children at risk. In one recent case, a one-year-old child was poisoned with an unknown amount of copper sulfate because the father, whose job entailed keeping swimming pools clean, stored it in a place within the child's reach. The child developed not only kidney and liver injuries but also a blood disorder.

Toxic substances present in vehicle emissions, cigarette smoke, illicit drugs, pharmaceuticals, cosmetics and many other consumer products pose health hazards that are often taken for granted because they have become part of daily routine in a consumer society. Again, people in developing countries are more at risk than those in developed countries.

In fact the dangers from chemicals are incalculable. It is not only human health that is at risk but also the environment. Unfortunately, few people are aware of this reality. There is an urgent need to stop the alarming trend towards poisoning humanity and the planet itself. Economic pursuit cannot justify the sacrifice of the basic right to health and a healthful environment. The citizenry, especially of the Third World, must take that important step of becoming part of the solution – be informed and take immediate action! ■

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*Washing out the pesticide sprayer in an irrigation canal risks contaminating the soil.*

# Pesticides can be a pest!

Jerry Jeyaratnam

*A large proportion of acute pesticide poisoning cases and deaths are the result of suicide or attempted suicide, using chemicals which are readily available. The most hazardous of these substances should therefore be securely controlled.*

Pesticides are agents which control pests that are harmful to mankind either by causing human disease or by damaging food crops. Most pesticides are chemicals, and they are chosen because of their beneficial effects in controlling human disease and their ability to increase food production. Pesticides can be classified according to the type of pests which they destroy, such as insecticides, rodenticides, fungicides or herbicides. It is also possible to classify them according to their chemical structure. But aside from their beneficial effects, many have the potential to cause harm to human health. They should therefore be used in ways that will maximize their benefits, while minimizing or totally controlling their adverse effects.

The use of chemicals as pesticides dates back to the classical Greek and Roman periods. Substances such as sulfur, arsenic, nicotine and pyrethrum have been used in various cultures and societies from ancient times. What is new is that now we have available extremely effective and therefore more toxic pesticides. Consequently there is increasing concern about their possible harmful effects, particularly since it is recognized that everybody is exposed to pesticides to some extent. The question that arises is whether such exposure is necessarily harmful. Two statements can help us to answer this.

*A face-mask ensures that this worker will not inhale pesticide if the wind changes direction.*

- "There are no harmless substances. There are only harmless ways of using substances."
- "All substances are poisonous – it is the dose that matters."

These statements underline the need to use pesticides safely, and at the same time help to allay anxieties about their potential to cause harm.

## One-fourth used in Third World

The use of pesticides is steadily increasing. About 25% of the current total use of pesticides occurs in the developing world, while globally it has doubled about every ten years since 1945. Their use in developing countries doubled between 1983 and 1993.

There are two types of exposure situations, one in which the exposure is for a limited period and the other for a prolonged and continuous period. The former may result in acute poisoning, and the effects follow soon after exposure. The second type may result in chronic poisoning, where the effects are not clearly linked to the exposure, i.e., there is a time-lag between exposure and effect, while the effects are usually due to prolonged exposure to the chemical at low-dose levels that do not cause any acute effects.

The acute and chronic toxic effects of pesticides may occur in the workplace (manufacture and packaging, mixing, spraying, etc.) or from non-occupational accidental exposure (eating or drinking contaminated food, etc.). Another important source of exposure to pesticides is intentional swallowing in suicides and attempted suicides.

The extent of acute pesticide poisoning is unacceptably large, although it is impossible to give precise figures for the number of cases on a world-wide scale. Almost all cases of acute pesticide poisoning occur in the developing world, even though it uses only 25% of the world's production of such substances. Industrialized countries have developed adequate control mechanisms to prevent such poisoning, even though they use pesticides extensively. The lesson for the developing world is that these chemicals can be used safely. A large proportion of cases and deaths occur as a result of suicides and attempted suicides. This indicates that pesticides are used as a suicidal agent because they are readily available.

## Long-term exposure

Pesticides may enter the body orally, or by breathing or through the skin. In acute poisoning at the workplace, the most important route of absorption is through the skin, whereas in accidental or intentional poisoning (suicide), the route of absorption is usually oral. The general public is exposed to these substances by contamination of the air, food and water from pesticide use for agricultural or public health purposes. The health consequences of such exposure is a matter of controversy, largely because of a lack of scientific data on the long-term effects of low doses of pesticides on human health.

## Controlling the problem

The control of chronic health effects resulting from exposure to pesticides calls for an open mind as well as further evidence from epidemiological studies on human populations.

As acute poisoning is an established and major concern in developing countries, urgent action is required now to control the problem. Since we know that about two-thirds of the problem is due to suicide, every effort must be made to control this social plague. One of the best approaches is to follow the example of the industrialized countries which control the availability of pesticides according to their hazard potential. This is particularly relevant to developing countries in that – even though these countries have legislation to control the availability of such chemicals – the legislation is poorly implemented due to a lack of resources. These countries need to consider a system of selectively applying legislation in order to focus attention on effectively controlling the availability of the most hazardous pesticides.

Such pesticides are readily identifiable from WHO's *Recommended classification of pesticides by hazard and guidelines to classification, 1992-1993*. Those substances belonging to class 1A ("extremely hazardous") and those in Class 1B ("highly hazardous") should have their availability severely controlled. This is a necessary step in any attempt to prevent the unnecessary deaths and acute poisoning cases due to pesticides. ■

*Increased use of pesticides makes it even more essential to monitor pollutant levels in food*

*Professor Jeyaratnam is Head of the Division of Occupational Medicine, and Head of the WHO Collaborating Centre for Occupational Health, National University of Singapore, Lower Kent Ridge Road, Singapore 0511.*

# WHO on ....

*Prenatal consultation in Costa Rica.*

# Making motherhood safer

"For many of the 150 million women who become pregnant every year, childbirth is not the joyous event it should be but a time of pain, fear, suffering and even death," Dr Tomris Türmen, Director of WHO's Division of Family Health, told a meeting of the Technical Working Group on the Care of Mother and Baby at the Health Centre, held in Geneva in July. The Group is charged with finding ways to make health care accessible to all and with defining the minimal maternal and child care that each health centre should be able to offer.

Countries sometimes devote up to 80% of their public health spending to high-technology interventions which are of low cost-effectiveness, while most of the needs could be met at much lower cost and more effectively by providing essential curative and preventive care at the health centre or clinic which serves the community, yet which today receives only a tiny share of investment.

A birth is a delicate event for the human species and entails certain risks. Yet more than 56 million deliveries take place each year without any skilled help – in many cases the mother is completely alone with her baby.

Up to one in three pregnancies (not counting abortions) develop complications, such as haemorrhage, sepsis, hypertensive disorders and obstructed labour, and half of these – around 23 million – need skilled treatment. Around 12.5 million pregnancies are complicated by a disease such as malaria, hepatitis, tuberculosis or diabetes. For half a million women every year such complications prove fatal, and when the mother dies the risk of death for surviving children – especially for girls – increases by up to 50%. Some 15 million women develop long-term disabilities such as obstetric fistulae (constant leaking of urine or faeces due to severe damage to the birth canal), severe anaemia, pelvic inflammatory diseases, reproductive tract infections and infertility. In addition, at least 26 million unsafe abortions each year are carried out under unhygienic conditions and these result in death, infections or bleeding.

Complications that affect women during pregnancy and delivery also affect the fetus. Of the 12.9 million deaths a year of children under five, around one-third occur before the baby is one month old and three million occur during the first week of life, largely as a consequence of poorly managed pregnancies or inadequate care of the baby during the first critical hours of life. Many millions of

babies who survive the birth process are badly damaged. For example, some 3% of newborn babies (3.6 million) suffer moderate or severe birth asphyxia following obstructed labour. Of these, about 800 000 die and an equal number suffer brain damage leading to cerebral palsy, seizures and serious learning disorders.

Complications can happen to any woman at any stage of the pregnancy and they can be fatal in a matter of hours. Yet most families in developing countries, particularly in rural areas, live far from a hospital and transport is rarely available. The only way to significantly reduce maternal and newborn deaths therefore is to ensure that the skilled care which women need is available as close as possible to where they live, and that those most in need are identified. This is precisely the function of the community health centre.

WHO's policy aims to strengthen such centres. As Dr Türmen made clear: "Many life-saving procedures can and should be performed by midwives and other non-physician health workers in more peripheral, less sophisticated facilities." The health centre has a community-oriented role and is the best place to inform, educate and take care of women and children's health needs effectively and at low cost.

Making a basic package of prenatal, delivery and postpartum care available to 80% of the developing world's women and newborn babies would cost US$ 4 to $9 per capita, and would reduce the burden of pregnancy-related mortality and ill-health by two-thirds. This is a small price to pay considering that the total health expenditure per person in developing countries in 1990 was estimated at $41 per annum. The moment of birth lays the foundation for a healthy childhood and adult life. Every woman in labour and every infant struggling to be born should have access to simple and appropriate diagnosis and treatment to ensure not only their survival but also their quality of life. ■

*Skilled care for the family close to where they live.*

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### In the next issue

How can a family keep healthy? What can it do to stand guard against disease and protect the health of each individual? The November-December 1993 issue of **World Health** will try to answer these vital questions in the context of the UN's Year of the Family – 1994. In this same issue the well-known Chinese-born writer Han Suyin describes her vision of the family of the future. ■


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